

AUTOMOBILE MANUFACTURING PROCESSES**Course Code : 314342****Programme Name/s : Automobile Engineering.****Programme Code : AE****Semester : Fourth****Course Title : AUTOMOBILE MANUFACTURING PROCESSES****Course Code : 314342****I. RATIONALE**

The automobile manufacturing industry is constantly upgrading to keep up with new trends and technologies. Therefore, students pursuing diploma engineering must stay abreast of these advancements in manufacturing technologies. This course equips students with the knowledge of various manufacturing processes employed in producing vehicle components. It enables them to select appropriate materials, tools, and practices for working in a plant setting, while also fostering a strong awareness of safety protocols through hands-on experience with CNC machine tools.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use various manufacturing processes for producing given automobile components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select suitable material for manufacturing of specific automobile component
- CO2 - Choose an appropriate heat treatment process for the given automobile component.
- CO3 - Prepare raw material for powder metallurgy and plastic processing applications
- CO4 - Use relevant surface processing operation for a given automobile component
- CO5 - Execute CNC part program for the given automobile components.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks	
				Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TL				Based on SL						
				CL	TL	LL						Practical										
												FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
														Max	Max	Max	Min	Max	Min	Max		Min
314342	AUTOMOBILE MANUFACTURING PROCESSES	AMP	AEC	4	-	4	-	8	4	3	30	70	100	40	25	10	25@	10	-	-	150	

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the properties, grades/designation of the given material with justification. TLO 1.2 Identify ferrous metal for the given automobile component with justification. TLO 1.3 Identify non-ferrous metal for the given automobile component with justification. TLO 1.4 Describe applications of the given materials in the given types of automobiles. TLO 1.5 Describe applications of the GRP in the given types of automobiles. TLO 1.6 Describe applications of the titanium and magnesium alloys in the given types of automobiles.	Unit - I Engineering Materials 1.1 Introduction: Need of advanced materials in automobile sector. Classification of engineering materials. Ferrous metals and their alloys: Cast iron: types, composition and applications. Plain carbon steel: types, composition and applications 1.2 Alloy Steels: Alloy steels, their composition and Application. Effects of alloying elements on the properties of steel. 1.3 Non-ferrous metals and their alloys: Aluminium and its alloys their composition, properties and applications. Copper and its alloys their composition, properties and applications. 1.4 Magnesium alloys: Properties and applications Titanium alloys: Properties and applications. 1.5 Other materials: Polymeric materials- properties and applications; Thermoplastics- Thermosetting Plastics-Epoxy resins and Polyesters. 1.6 Rubber – Natural and synthetic Ceramic materials: Properties and application in automotive industry; Composites: Properties and applications of Glass fiber (GRP/GFRP), Carbon fiber (CRP/CFRP)	Presentations, Case Study, Collaborative learning, Lecture Using Chalk-Board, Cooperative Learning,

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Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Interpret the given Iron-iron carbide (Fe-Fe₃C) equilibrium diagram. TLO 2.2 Describe with sketches the given type of heat treatment process and its application. TLO 2.3 Differentiate the features of the given heat treatment processes. TLO 2.4 Select the relevant heat treatment process for the given automobile component with justification.	Unit - II Heat Treatment 2.1 Introduction: Concept of phase and phase transformations, phase Cooling curve for pure iron, Iron-Iron carbide (Fe-Fe₃C) equilibrium diagram. CCT and TTT diagrams. Need of heat treatment. 2.2 Common heat treatment processes and their applications in Automobile sector: Annealing, Normalizing, Hardening, Tempering, Surface hardening processes: Case carburizing, Nitriding, Cyaniding, Induction and Flame hardening.	Lecture Using Chalk-Board Video Demonstrations, Collaborative learning, Presentations.
3	TLO 3.1 Describe various processes used for production of metallic powder. TLO 3.2 Enlist advantages and disadvantages of powder metallurgy. TLO 3.3 Describe extrusion process of plastics. TLO 3.4 Describe with relevant examples of industrial applications of Transfer molding. TLO 3.5 Differentiate between plunger and screw Injection molding machines. TLO 3.6 Compare Blow molding and transfer molding.	Unit - III Powder Metallurgy and plastic processing 3.1 Powder Metallurgy: Introduction. 3.2 Production of metallic powder. 3.3 Processing methods. 3.4 Advantages, Disadvantages and applications. 3.5 Secondary operations. 3.6 Plastic processing-Extrusion of plastics. 3.7 Injection molding – Plunger and screw machines. 3.8 Compression molding Transfer and Blow molding – Typical industrial applications.	Video Demonstrations, Lecture Using Chalk-Board, Demonstration, Presentations.
4	TLO 4.1 Select the relevant surface cleaning process for the given material(s). TLO 4.2 Explain with sketches the relevant surface coating process for the given component. TLO 4.3 Describe various types of mechanical and chemical cleaning processes. TLO 4.4 Explain with sketches the relevant surface finishing process for the given component with justification. TLO 4.5 Enlist applications of various surface processing operations.	Unit - IV Surface Processing Operations 4.1 Surface cleaning processes- acid, alkaline, electrolytic cleaning, blasting and tumbling. 4.2 Metallic surface coating- Electroplating, Galvanizing, metal spraying, painting process, powder coating. 4.3 Surface finishing processes: Lapping, honing, super finishing, polishing, buffing, burnishing and their applications.	Presentations, Lecture Using Chalk-Board, Video Demonstrations, Collaborative learning.

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Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe the functions of the various element(s) of the CNC Machine. TLO 5.2 Interpret the given CNC part programming code(s). TLO 5.3 Prepare part programme using G and M codes for the given automobile component. TLO 5.4 Explain the function of ATC and APC.	Unit - V CNC Machines and Part Programming 5.1 CNC machines: Types, classification, working and constructional features, advantages, limitations. 5.2 Elements of CNC machines - Types, sketch, working and importance of: Automatic tool changer (ATC), Automatic pallet changer (APC). 5.3 Definition and importance of various positions like machine zero, home position, work piece zero and programme zero. 5.4 CNC part programming: programming format and structure of part programme. 5.5 ISO G and M codes for turning and milling-meaning and applications and important codes. 5.6 Simple Part programming as per ISO codes on CNC and VMC for operations like turning, drilling and Milling.	Presentations, Lecture Using Chalk-Board, Video Demonstrations, Collaborative learning.

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify the material of given automobile components. LLO 1.2 Distinguish in ferrous and non-ferrous materials as per their characteristic features.	1	*Identification of materials of automobile components	2	CO1
LLO 2.1 Identify at least five automobile polymer material components. LLO 2.2 Distinguish in plastic and rubber materials as per their characteristic features.	2	Collection of different polymers components used in a vehicle.	2	CO1
LLO 3.1 Select suitable equipment for given heat treatment. LLO 3.2 Interpret metallurgical changes in given component.	3	Annealing process of plain carbon steel	4	CO2
LLO 4.1 Select suitable equipment for given heat treatment. LLO 4.2 Measure hardness of given sample before and after process	4	* Hardening (Quenching) process of plain carbon steel	4	CO2
LLO 5.1 Select suitable equipment for given heat treatment. LLO 5.2 Choose suitable process parameters for given process.	5	Tempering process of plain carbon steel	4	CO2
LLO 6.1 Select suitable tools used to produce the metal powder LLO 6.2 Distinguish between different powder production methods.	6	*Production of aluminium metal powder.	4	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Interpret the specification of given blow molding machine LLO 7.2 Identify various components. LLO 7.3 Prepare a detail report on blow molding machine including purpose and industrial applications	7	*Demonstration of blow molding machine	2	CO3
LLO 8.1 Select suitable tool/ tools to prepare the surface for painting operation. LLO 8.2 Perform suitable operation for preparation of surface.	8	*Preparation of surface for painting process	4	CO4
LLO 9.1 Select suitable tool for hand lapping operation. LLO 9.2 Apply suitable abrasive material. LLO 9.3 Perform lapping operation.	9	Hand lapping operation	2	CO4
LLO 10.1 Select suitable buffing wheel for given application. LLO 10.2 Perform buffing operation.	10	Buffing operation	2	CO4
LLO 11.1 Identify different elements of CNC machine. LLO 11.2 Observe systems and subsystem	11	Surface polishing operations	4	CO4
LLO 12.1 Identify different elements of CNC machine. LLO 12.2 Observe systems and subsystem LLO 12.3 Prepare a report including specifications, features, control systems, industrial applications etc.	12	*Demonstration of CNC Machines.	2	CO5
LLO 13.1 Select required G codes and M codes LLO 13.2 Set the work and tool offset on CNC as per operations	13	* Work and tool offset setting on CNC machine.	4	CO5
LLO 14.1 Select required G codes and M codes LLO 14.2 Select suitable tools LLO 14.3 Prepare part programme for given operation LLO 14.4 Execute part Programme	14	*CNC part Programming- Turning operation	4	CO5
LLO 15.1 Select required G codes and M codes LLO 15.2 Select suitable tools LLO 15.3 Prepare part programme for given operation LLO 15.4 Execute part Programme	15	*CNC part Programming- Drilling operation	4	CO5
LLO 16.1 Select required G codes and M codes LLO 16.2 Select suitable tools LLO 16.3 Prepare part programme for given operation LLO 16.4 Execute part Programme	16	CNC part Programming- milling operation	4	CO5

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 17.1 Select required G codes and M codes LLO 17.2 Select suitable tools LLO 17.3 Prepare part programme for given operation LLO 17.4 Execute part Programme	17	CNC part Programming- milling and drilling operation	4	CO5
LLO 18.1 Enlist various ancient Indian material development process. LLO 18.2 Compare ancient Indian material development process with recent process.	18	*Comparison of ancient Indian material development processes with current processes. (IKS)	2	CO1 CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**Assignment**

- Collect information related to machineries related to powder metallurgy, and prepare report which contains their manufacturers, raw materials, products etc.
- Collect information related to plastic processing machineries, and prepare report which contains their manufacturers, raw materials, products etc.
- Collect information related to machineries related to grinding and superfinishing, and prepare report which contains their manufacturers, raw materials, products etc.
- Collect information on special attachments used in CNC machine like Automatic tool changer etc
- Collect different G codes and M codes used in different operating control systems (Siemens, Fanuc, Mazac, mitsubishi etc.)
- Prepare detailed list of different components of the automobile, classify it, give their manufacturing processes.

Micro project

- Case study on preparation on part programme for given production drawing of component.
- Collect different tools used for CNC operations give their specifications, characteristic features and materials.
- Prepare survey report on advanced materials used in automobile industries.
- Collect automobile components on which Lapping, honing, buffing, polishing, Electroplating, Galvanizing, metal spraying and powder coating are performed. For each process collect information about the material, machines and other resources required. Also prepare list of industries in your state doing these processes.
- Prepare model of blow molding machine and show all its components with specific features.
- Prepare model of automatic tool changer and show all its components.
- Prepare model of automatic pallet changer and show all its components.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	CNC lathe (turning centre) Oi-mate TD. 02. Capacity	11
2	VMC Machine. 1200M. Table size, mm, 1200 x 510, 1500 x 630. Traverses X, Y & Z axes, mm, 1000 x 500 x 500(l), 1200 x 600 x 600. Rapid rate, m/min, 12 (standard), 20/32 (optional),	13
3	Hardness Tester (Rockwell Type)	2
4	Demonstration model of blow molding machine.	2
5	High Temperature Oven (Capable of up to 1000o C)	7
6	Set of common hand and power tools	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Engineering Materials	CO1	16	2	8	6	16
2	II	Heat Treatment	CO2	10	4	6	4	14
3	III	Powder Metallurgy and plastic processing	CO3	10	2	8	4	14
4	IV	Surface Processing Operations	CO4	8	4	2	4	10
5	V	CNC Machines and Part Programming	CO5	16	2	8	6	16
Grand Total				60	14	32	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- term work , class tests

Summative Assessment (Assessment of Learning)

- End semester examination theory , End semester examination Lab performance(Internal)

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	-	2	2	2	3	2			
CO2	3	2	-	2	2	3	2			
CO3	3	2	-	3	-	3	-			
CO4	3	2	2	3	-	3	2			
CO5	3	3	2	3	-	3	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	G.K.Awari, V.S.Kumbhar, R.B.Tirpude, S.W.Rajurkar	Automobile manufacturing Processes: A case study approach	CRC Press First Edition 9781003367321, 978-1032312385
2	Serope Kalpakjian Steven R. Schmid	Manufacturing Engineering and Technology	Pearson ISBN 978-9353062910
3	M. Adithan (Aut B.S. Pabla)	CNC Machines	New age international ISBN 978-8122434262
4	Rajput R. K.	Engineering Materials and Metallurgy	S. Chand Limited, New Delhi. 2013, ISBN 13: 9788121927093
5	Kodgire V. D.	Material Science and Metallurgy	Everest Publishing House , Pune. 1020, ISBN: 9788186314005, 8186314008
6	Rao P.N.	CAD/CAM Principles and applications	McGraw-Hill Publishing Co. Ltd, New Delhi, 2012, ISBN:9780070681934
7	Sharma P.C.	Production technology	S. Chand, Mumbai, 2006,ISBN: 9788121911146
8	Mikell P. Groover	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems	John Willey and Sons , 4th edition ISBN 978-0470467008

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=_p7cSr3F1F8&list=PLSGws_74K01g9nnTMBssGURHawYYQfMQ&index=52	heat treatment
2	https://www.youtube.com/watch?v=gQ5x5DpILg8&list=PLSGws_74K01g9nnTMBssGURHawYYQfMQ&index=55	heat treatment

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Sr.No	Link / Portal	Description
3	https://www.youtube.com/watch?v=azGg68B-Glk	Powder metallurgical processes
4	https://www.youtube.com/watch?v=qn16JtE_vLc	Plastic processing technology
5	https://www.youtube.com/watch?v=ZfDqTc3vhvE&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ&index=58	Coating process
6	https://www.youtube.com/watch?v=-Kxz7Nt8C5I	Tumbling Process
7	https://www.youtube.com/watch?v=n2J1Wlfw-Dw	CNC tools and tool holders
8	https://www.youtube.com/watch?v=lEyNWtM6MW4	CNC machine working

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024**Semester - 4, K Scheme**